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AUTHORITY	
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U S NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1048

RESEARCH AND DEVELOPMENT TESTS IN REPORT OF
BOMB FUZING SYSTEMS

32nd Partial Report

ROCKET LAUNCHER TESTS OF
ELECTRIC BOMB FUZE EX-200 MOD 3

FINAL Report

Copy No. 6

Task

Assignment MPG-Re2b-20-1-52

Classification CONFIDENTIAL
SECURITY INFORMATION

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3
-----PART ASYNOPSIS

1. The preceding phase of the test program on the EX-200 Mod 3 electric bomb fuze being developed by the Daystrom Electric Corp. produced the following results:

a. A satisfactory method of firing 250 lb. low drag bombs from the Naval Proving Ground's 500 ft. launcher.

b. The extended foil type of condenser functioned satisfactorily when subjected to cross-axial shocks but both types shorted out from shocks in an axial direction.

c. Two prearmed fuzes in 250 lb. G.P. bombs functioned satisfactorily on 1" STS plate fired at 900 ft./sec. with jiggle switches stiff enough to resist launcher vibrations.

d. Three EX-200 Mod 3 mock up fuzes (having timing circuits designed to arm the fuze between the end of the launcher and the target) tested for sensitivity in 250 lb. low drag bombs failed to fire upon impact with 1/4" STS plate target.

2. This test was conducted to:

a. Test fuzes with redesigned components intended to correct previous failures plus further development toward completion of fuze design.

b. Determine the impact sensitivity of the fuze with 35G trigger switches.

c. Determine the functional ability of the EX-200 Mod 3 fuze to arm and fire after heavy plate impact.

3. It is concluded that:

a. The mock up EX-200 Mod 3 bomb fuze containing a 35G trigger switch (as indicated by the limited number of rounds fired during this test) is sufficiently sensitive to function on 1/16" to 1/8" mild steel targets at a striking velocity of 900 ft./sec.

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

b. The previous problem of consistent Condenser-Resistance-Condenser circuit failure during heavy impact tests has been corrected.

c. Faulty pyrotechnic actuators caused five arming failures during the heavy impact test.

d. Fuze functioning failure occurred on 1 out of 14 rounds as a result of having the S3 switch held down by extraneous material introduced during target penetration. Bomb Yaw at the time of impact would increase the exposure of the S3 switch to target debris.

4. It is recommended that:

a. The S3 switch be changed so that it can not cause sterilization of the fuze during impact and before the later stages of arming in the event that it is held down by material picked up during target penetration.

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3
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Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3
-----PART BINTRODUCTION

1. AUTHORITY:

This test was conducted in accordance with references (a), (b), (c), and (d) as authorized by reference (a) under Task Assignment NPG-Re2b-20-1-52.

2. REFERENCES:

- a. NOL conf ltr NP/NOL/X1-1(1258) WA:NCB:gbh Ser 01811 of 9 Oct 1951
- b. NOL Work Request WA-3 of 3 Dec 1951
- c. NOL Work Request WA-4 of 3 Dec 1951
- d. NOL Work Request WA-24 of 18 Mar 1952
- e. NPG Report No. 892 of 17 Dec 1951

3. BACKGROUND:

The preceding phase of the test program on the EX-200 Mod 3 electric bomb fuze being developed by the Daystrom Electric Corp. produced the following results:

- a. A satisfactory method of firing 250 lb. low drag bombs from the Naval Proving Ground's 500 ft. launcher.
- b. The extended foil type of condenser functioned satisfactorily when subjected to cross-axial shocks but both types shorted out from shocks in an axial direction.
- c. Two prearmed fuzes in 250 lb. G.P. bombs functioned satisfactorily on 1" STS plate fired at 900 ft./sec. with jiggle switches stiff enough to resist launcher vibrations.
- d. Three EX-200 Mod 3 mock up fuzes (having timing circuits designed to arm the fuze between the end of the launcher and the target) tested for sensitivity in 250 lb. low drag bombs failed to fire upon impact with 1/4" STS plate target.

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

4. OBJECT OF TEST:

a. This test was conducted to:

(1) Test fuzes with redesigned components intended to correct previous failures plus further development toward completion of fuze design.

(2) Determine the impact sensitivity of the fuze with 35G trigger switches.

(3) Determine the functional ability of the EX-200 Mod 3 fuze to arm and fire after heavy plate impact.

5. PERIOD OF TEST:

a. Date Project Letter	9 October 1951
b. Dates Necessary Material Received	3 December 1951 26 May 1952
c. Date Commenced Test	4 December 1951
d. Date Test Completed	11 June 1952

6. REPRESENTATIVES PRESENT:

Mr. N. C. Butler
Mr. D. K. Tower

Naval Ordnance Laboratory
Daystrom Electric Corp.

PART CDETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. Photographs of the assembled EX-200 Mod 3 fuze and its components are shown as Figures 1, 2, and 3. Figure 4 is a schematic, electrical wiring diagram. The fuze has three electrical initiated pyro-delays which can be selected in accordance with the target.

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

b. Component modifications and improvements incorporated in the fuze since date of tests reported in reference (e):

- (1) Improved high shock condensers.
- (2) Improved 2 sec. and 4-1/2 sec. pyrotechnic actuators.
- (3) Slight design changes in the top end of the fuze with particular regard to the rod which operates S3 switch to make it less susceptible to water entry and subsequent freezing.
- (4) Improvements in manufacturing processes on various fuze components without radical design changes.
- (5) Steel reinforcement sleeve 1/16" thick placed around the electrical component block to prevent distortion of the block by the heavy top end of the fuze during target impact.
- (6) Booster size reduced and booster cover crimped on instead of threaded on.
- (7) Fuzes hermetically sealed between the fuze housing and bulkhead and between the housing and top end by the Metal-Matic process.

c. The mock up fuzes fired for target impact sensitivity consisted primarily of Condenser-Resistance-Condenser timing circuits, Victoreen Diode tubes and firing condensers, and primers connected to jiggle switches.

8. DESCRIPTION OF TEST EQUIPMENT:

Test Vehicles:

250 lb. G.P. Bomb AN-M57A1 Vermiculite-Cement loaded with cross-axial fuze liner midway.

250 lb. Low Drag Bomb EX-2, Vermiculite-Cement loaded. Figure 5

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3
-----Propelling Force for
Test Vehicles:

250 lb. G.P. Bomb-Three 570 rocket motors Mk 2 Mod 3 mounted in special carriage.

250 lb. Low Drag Bomb-Three 570 rocket motors Mk 2 Mod 3 mounted in special carriage with 3725 motor Mk 7 in tail of bomb. The 3725 motor was used primarily to separate the bomb from the carriage.

Launcher:

NPG 500 ft.

Fuze Charging Equipment:

Daystrom Electric Corp.

Targets:

1/32", 1/16", 1/8", 1/4" mild steel, 1/2", 3/4", 1" STS (homogenous armor plate).

7032, 1/16", and 1/8" 24ST aluminum alloy, 1/4", 1/2", 3/4" plywood.

Velocity Measurements:

Counter chronograph and oscillograph.

Cameras:

35mm Mitchell and Bowen Acceleration.

9. PROCEDURE:

a. Rounds 1 through 21, fired for impact sensitivity, were charged at the muzzle of the launcher; charging voltage was 270 volts D.C. The 3725 separation motors on rounds 1 through 12 were ignited 55 ft. before the end of the launcher.

b. On rounds 22 through 26 the separation motor was ignited at the muzzle of the launcher.

c. On rounds 22 through 26 the fuze charging screens were increased in length from 30" to 50", thus increasing the charging time.

d. The 17 rounds fired for heavy plate impact had their condensers charged before firing with 200-210 volts D.C. Before each round was fired the fuzes and charging gear were electrically tested.

Rocket Launcher Tests of Electric Bomb Fuse EX-200 Mod 3

e. The first five rounds fired for heavy plate impact were 250 lb. Low Drag Bombs, partially cement loaded. The fuzes contained all components except the tetryl lead-ins and live boosters. They were not hermetically sealed and had threaded booster covers.

f. The last 12 rounds fired for heavy plate impact were hermetically sealed and had crimped booster covers.

10. RESULTS OF TEST:

a. Tabulated test results are found in Tables I and II. Detailed impact records are found in Appendix (B).

b. Results of the sensitivity test were rather inconclusive due to the small number of rounds fired. However, using a 35G switch, a 1/16" or 1/8" mild steel target was sufficient to cause detonation of more than 50% of the fuzes fired at them, Figure 6.

c. During the sensitivity tests two fuzes with 35G switches detonated prematurely, approximately 25 ft. before the target. This may have been caused by excessive vibration in the bomb built up during its flight down the launcher or possibly as a result of an interruption in the burning of the 3#25 separation motor in the tail of the bomb. Such interrupted burning might produce a deceleration in the round.

d. On many of the sensitivity tests two targets were used. A thin target was placed at 200 ft. from the launcher muzzle and a heavier one at 250 ft. was certain to provide sufficient deceleration to cause the fuze to function. Consequently, the number of rounds fired, as shown in the tables, do not correspond to the number of target results indicated.

e. Most of the dud rounds occurring on 1/16", 1/8" and 1/4" mild steel targets resulted during a period in which it is believed there may have been some fault in the fuze charging method. Several changes in the charging method (but not in the fuzes), prior to the last 5 rounds fired, resulted in successful functioning on targets which had previously produced duds.

f. Additional tests of target sensitivity will be conducted during the evaluation program.

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Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

g. Summary of Heavy Impact Test (in 250 lb. G.P. bombs)

<u>No. of Rounds</u>	<u>STS Target</u>	<u>Striking Velocity</u>	<u>Fuze Delay Arming</u>	<u>Fuze Functioning</u>	
				<u>HO</u>	<u>Dud</u>
5	170	Average 900 ft./sec.	Approx. 10 sec.	2	3
6	3/4"	Average 900 ft./sec.	Approx. 10 sec.	2	4

Note: One round fired against 1" STS was not recovered and is not listed in above results.

(1) A study of Table II (Heavy Plate Impact Test) shows that the charging procedure was not the cause of the seven duds. The defect in five appears to be a failure of the pyrotechnics to operate their respective switches. In one case the Condenser-Resistance-Condenser circuits may have failed. The last failure may have been caused by the discharging of part of the Condenser-Resistance-Condenser circuit energy through the S3 switch which was held down by wood from the target impact. The recovered fuzes have been delivered to the Naval Ordnance Laboratory for further investigation. Figure 7 shows a typical round in flight during the heavy impact test.

PART D

CONCLUSIONS

11. It is concluded that:

a. The mock up EX-200 Mod 3 bomb fuze containing a 35G trigger switch (as indicated by the limited number of rounds fired during this test) is sufficiently sensitive to function on 1/16" to 1/8" mild steel targets at a striking velocity of 900 ft./sec.

b. The previous problem of consistent Condenser-Resistance-Condenser circuit failure during heavy impact tests has been corrected.

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Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

c. Faulty pyrotechnic actuators caused five arming failures during the heavy impact tests.

d. Fuze functioning failure occurred on 1 out of 14 rounds as a result of having the S3 switch held down by extraneous material introduced during target penetration. Bomb Yaw at the time of impact would increase the exposure of the S3 switch to target debris.

PART E

RECOMMENDATIONS

12. It is recommended that:

a. The S3 switch be changed so that it can not cause sterilization of the fuze during impact and before the later stages of arming in the event that it is held down by material picked up during target penetration.

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Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

The tests upon which this report is based were conducted by:

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Rocket Battery
Terminal Ballistics Department

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REF ID: A66747

U. S. NAVAL PROVING GROUND
DARTMOUTH, VIRGINIA

Thirty-Second Partial Report

on

Research and Development Tests in Report of
Bomb Fuzing Systems

First Partial Report

on

Rocket Launcher Tests of
Electric Bomb Fuze EX-200 Mod 3

Project No.: NPG-Re2b-2C-1-52
Copy No.: 6
No. of Pages: 11

Date: NOV 12 1952

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TABLE 1
IMPACT SENSITIVITY TEST OF RDX NO. 1 BURNING FOR TIME

Date Range	No. No.	Velocity (ft/s)	Desired Distance	Actual Distance	Impact 200 Ft. from Launcher			Impact 100 Ft. from Launcher			Remarks
					Material	Distance	Time	Material	Distance	Time	
12-4-51	1	920	921	921	1/4" MS	NO 6 Ft. Delay	---	None	---	---	Blade Hit Holder for Fuse Charging Screen 51:00. y. Bomb went into river.
12-5-51	2	920	946	946	1/8" MS	---	---	None	---	---	Contact Blade knocked off on launcher before hitting charging screen. No ignition of boost motor or charging of fuse.
12-5-51	3	920	923	923	1/8" MS	---	---	None	---	---	Premature functioning 33 Ft. before target possibly caused by a sudden change of acceleration.
12-6-51	4	920	916	916	1/8" MS	---	---	None	---	---	
12-6-51	5	920	916	916	1/8" MS	---	---	None	---	---	
12-6-51	6	920	920	920	1/8" MS	---	---	None	---	---	
12-6-51	7	920	926	926	1/8" MS	---	---	None	---	---	
12-12-51	8	920	943	943	1/8" MS	---	---	None	---	---	Charging System on Rds 22-26 modified by increasing charging screen from 30" to 50" which increased charging time. Separation motor on Rds. 22-26 Ignited at end of launcher after target penetration as checked by means of film record. Bomb went into river.
12-12-51	9	920	943	943	1/8" MS	---	---	None	---	---	
12-12-51	10	920	942	942	1/8" MS	---	---	None	---	---	
12-12-51	11	920	942	942	1/8" MS	---	---	None	---	---	
12-12-51	12	920	940	940	1/8" MS	---	---	None	---	---	
12-27-51	13	920	926	926	1/8" MS	---	---	None	---	---	High Order
12-27-51	14	920	926	926	1/8" MS	---	---	None	---	---	
12-27-51	15	920	922	922	1/8" MS	---	---	None	---	---	
12-28-51	16	920	921	921	1/8" MS	---	---	None	---	---	
12-28-51	17	920	945	945	1/8" MS	---	---	None	---	---	
1-9-52	18	920	945	945	1/8" MS	---	---	None	---	---	NO 8 Ft. Delay Separation motor on Rds. 19-21 Ignited 33 Ft. before end of launcher.
1-10-52	19	920	936	936	1/8" MS	---	---	None	---	---	
1-10-52	20	920	937	937	1/8" MS	---	---	None	---	---	
1-10-52	21	920	927	927	1/8" MS	---	---	None	---	---	
1-17-52	22	920	947	947	1/8" MS	---	---	None	---	---	
1-17-52	23	920	940	940	1/2" Plywood	NO 25 Ft. Before Target	---	None	---	---	NO 8 Ft. Delay NO 10 Ft. Delay
1-18-52	24	920	946	946	1/2" Plywood	---	---	None	---	---	
1-18-52	25	920	949	949	1/2" Plywood	---	---	None	---	---	
1-18-52	26	920	941	941	1/2" Plywood	---	---	None	---	---	
1-18-52	26	920	941	941	1/2" Plywood	---	---	None	---	---	

APPENDIX A

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(LAW OFFICE OF JAMES M. HARRIS)

WILLIAMS

200 100 50 25 10 5 2 1

PLATE 1 - 2004 LOT 2004 EL-3-BERRY LOADED

[illegible]

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IMPACT RECORD

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIAIMPACT NO. 59906IMPACT DATE 5-26-52NPG TEST NO. T-2219-1.8OBJECT Impact test of electric bomb fuze in 250 lb. G. P.
BombReference: NPG ~~501~~ REPORT NO. 1048

dated

Reference: Bomb ltr. NPG 501-1048

dated

Task Assignment No. 501-1048-1048

dated

PLATE TARGET

Gage 0.75 class STS
Maker U. S. Steel
No. 0157663 Group U-526-832
Dimensions 8 1/2" x 250"OBLIQUITY 0°PENETRATION CompleteThickness at impact .75
No. of impact on plate 3
Dist. from nearest impact 47"
Dist. from near edges 46" and 118"
Impact area 13" x 22"
Spall: Front 0 Back 0
Dish 3" Spur 7"
Cracks 0
Punching (thrown) (started)
Back Button (thrown) (started)
Bulge 0
Through opening 12" x 19"

BOMB

ROCKET

HEAD: Cal. 5" Type G. P. Bomb
Mark M57 Mod No. Wt. 250.0#
Maker
Lot No.
Filler: Type Verm Wt. -
Fuzes Ex-200 Mod 2 No 1215
w/ primers and dets.
Boosters 2
Wt. of head (as fired) 250.0#MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 90° Wt. 80.90#COMPLETE ROUND: Mark Mod
Wt. (as fired) 330.90#
Wt. (burned)OTHER INFORMATION RMMA-119-11A-45LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight Mean Velocity, f/s: Strong 911 Residual -
Fuze functioning
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round INTA-1
Head was in (EFFECTIVE) (EFFECTIVE) condition.REMARKS: 2 sec Arming Actuator fired. 31 found. 4 1/2 sec arming actuator did not fire. It's quite recovered in good condition. 32 did not close.
Head fuze was found 3 sec after it was fired. It was in good condition.Photo No. -Signed F. W. Keady for RTCR. T. CROWELL, 1h
Ord. Eng.

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IMPACT RECORD

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 39967

IMPACT DATE 5-27-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G.P. Bomb

Reference: NPG NM 147 Report No. 1048 dated _____
 Reference: ~~ENOWD~~ ltr. NAAM/41-11258 NAAMC dated 11 Dec 1951 of 9 Oct 1951
 Task Assignment No. NAAM-1048-1-1 dated 4 Aug 1951

PLATE TARGET

Gage 0775 Class STS
 Maker U. S. Steel
 No. 0157663 Group U-S26-832
 Dimensions 83-1/2" x 250"

OBLIQUITY 0°

PENETRATION Complete
 Thickness at impact 75
 No. of impact on plate 4
 Dist. from nearest impact 42"
 Dist. from near edges 48" and 160"
 Impact area 18" x 48"
 Spall: Front 0 Back 0
 Dish 4" Spur 3"
 Cracks 0
 Punching (thrown) (started)
 Back Button (thrown) (started)
 Bulge 0
 Through opening 17" x 47"

ROCKET

BOMB

HEAD: Cal. _____ Type G. F. Bomb
 Mark M57 Mod _____ No. _____ Wt. 250.0#
 Maker _____
 Lot No. _____
 Filler: Type Verm. Wt. _____
 Fuzes Ex-200 Mod 3 NAAM-1048-1-1
 w/ primers and dets.
 Boosters 2
 Wt. of head (as fired) 250.0#

MOTOR: Cal. 5" Mk. 2 Mod 3
 Motor temp. 90° Wt. 80.85#

COMPLETE ROUND: Mark _____ Mod _____
 Wt. (as fired) 330.85#
 Wt. (burned) _____

OTHER INFORMATION RMDA-56-HA-45

"-119-"

"-1019-"

LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight _____ Velocity f/s: Striking Mean 927 Residual _____
 Fuze functioning fuze fired through to booster
 Explosive action (High Order) (Low Order) (None)
 Distance of burst behind plate _____
 Condition of recovered round _____
 Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS: Impact 1 fuze fired, was 10 ft. from edge
2 sec. actuator fired, switch closed. 4 sec. actuator fired, switch closed
11 sec. primer fired

Photo No. _____

Signed

F. W. Kaadon for RTC
 R. T. CROWELL, 1h
 Ord. Eng.

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IMPACT RECORD

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 39968

IMPACT DATE 5-27-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G.P. Bomb

Reference: NPG ~~Report~~ *Report No. 1248*

dated

Reference: ~~EXORD~~ ltr. ~~NPG~~ *Report No. 1248*dated *Ser 01811 of 9 Oct 1951*Task Assignment No. ~~NPG-2219-1-52~~dated *4 Apr 1951*

PLATE TARGET

Gage 0775 Class STS
 Maker U. S. Steel
 No. 0138073 Group U-S26-822
 Dimensions 90" x 250"

OBLIQUITY 0°PENETRATION Complete

Thickness at impact 775
 No. of impact on plate 3
 Dist. from nearest impact 49"
 Dist. from near edges 46" and 1138
 Impact area 16" x 22"
 Spall: Front 0 Back 0
 Dish 3" Spur 13"
 Cracks 0
 Punching (thrown) (started)
 Back Button (thrown) (~~started~~)
 Bulge 0
 Through opening 15" x 21"

ROCKET

BOMB

HEAD: Cal. 5" Type G.P. Bomb
 Mark M57 Mod 2 No. 3 Wt. 250.0#
 Maker Ex-200
 Lot No. Mod 3
 Filler: Type Ver. Wt. 124
 Fuzes Ex-200 Mod 3 No 124
w/primers and dets.
 Boosters 2
 Wt. of head (as fired) 250.0#

MOTOR: Cal. 5" Mk. 2 Mod 3
 Motor temp. 90° Wt. 78.60#

COMPLETE ROUND: Mark 328.60#
 Wt. (as fired) 328.60#
 Wt. (burned)

OTHER INFORMATION RMDA-1020-HA-45LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight Mean Velocity, f/s: Striking 944 Residual INTACT
 Fuze functioning Striking
 Explosive action (High Order) (Low Order) (None)
 Distance of burst behind plate
 Condition of recovered round

Bomb head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS: *1. Bomb was in (EFFECTIVE) condition. 2. Bomb was in (INEFFECTIVE) condition. 3. Bomb was in (EFFECTIVE) condition. 4. Bomb was in (INEFFECTIVE) condition.*

Photo No. _____

Signed

F.W. Kasdorf for RTC
 R. T. CROWELE, 1h
 Ord. Eng.

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Security INFORMATION

IMPACT RECORD

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 39969

IMPACT DATE 5-27-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G.P. Bomb

Reference: NPG ~~ltr.~~ Report No. 1048

dated

Reference: ~~Bureau~~ ltr. AF/MOL/AL-1 (1258) WA:RCS

dated Ser. 01711 of 7 Oct 1951

Task Assignment No. NPG-Recb-22-1-52

dated 4 May 1951

PLATE TARGET

Gage 170 Class STS
Maker Lukens
No. #50 Group L-30
Dimensions 96" x 348"

OBLIQUITY 0°

PENETRATION Complete

Thickness at impact 170

No. of impact on plate 3

Dist. from nearest impact 0

Dist. from near edges T49" and R57"

Impact area 17" x 23"

Spall: Front 0 Back 0

Dish 4" Spur 1"

Cracks 0

Punching (thrown) (started)

Back Button (thrown) (started)

Bulge 0

Through opening 16-1/4" x 22-1/4"

ROCKET

BOMB

HEAD: Cal. Type G. P. Bomb
Mark M57 Mod No. Wt. 250.0#

Maker

Lot No.

Filler: Type Verm. Wt.

Fuzes Ex-200 Mod 3 42, 226

w/primers and dets.

Boosters 2

Wt. of head (as fired) 250.0#

MOTOR: Cal. 5" Mk. 2 Mod 3

Motor temp. 90° Wt. 80.75#

COMPLETE ROUND: Mark Mod

Wt. (as fired) 330.75#

Wt. (burned)

OTHER INFORMATION RMDA-987-BA-45

" -1025- "

" - " - "

LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight Velocity, f/s: Striking Mean 940 Residual

Fuze functioning ~~None~~

Explosive action (High Order) (Low Order) (None)

Distance of burst behind plate

Condition of recovered round

Round was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS: *Large amount*

Photo No.

Signed *F. W. Kador* *RTC*

R. T. CROWELL, IN

Ord. Eng.

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IMPACT RECORD

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIAIMPACT NO. 39972IMPACT DATE 5-28-52NPG TEST NO. T-2219-1.8OBJECT Impact test of Ex-200 Electric Bomb Fuze in
250# G. P. BombReference: NPG ltr. Report No. 1078 dated
Reference: ltr. NPG 41-10-52 dated Sec 01311 of Post 1951
Task Assignment No. NPG-2219-1-8 dated 4 Apr 1952

PLATE TARGET

Gage 1.0 Class STS
Maker Lukens
No. 50 Group L-30
Dimensions 96" x 348"OBLIQUITY 0°PENETRATION Complete
Thickness at impact 1.0
No. of impact on plate 4
Dist. from nearest impact 42"
Dist. from near edges 42" and 1152"
Impact area 14" x 23"
Spall: Front 0 Back 0
Dish 3" Spur 5"
Cracks 0
Punching (thrown) (started)
Back Button (thrown) (~~marked~~)
Bulge 0
Through opening 12" x 21"

BOMB

HEAD: Cal. Type G.P. Bomb
Mark M57 Mod No. Wt. 250.0#
Maker -
Lot No.
Filler: Type Ver. Wt.
Fuzes Ex-200 Mod 3 #1078, with
primers and detonators
Boosters 2
Wt. of head (as fired) 250.0#MOTOR: Cal. 5 Mk. 2 Mod 3
Motor temp. 95° Wt. 80.65#COMPLETE ROUND: Mark Mod
Wt. (as fired) 330.65#
Wt. (burned) OTHER INFORMATION RMDA-619-HA-45
" -56-H-45
" -100- "LAUNCHER 500 ft. Rocket Launcher

ROCKET PERFORMANCE

Flight Velocity, f/s: Mean 957 Residual
Fuze functioning
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round
Head was in (EFFECTIVE) (INEFFECTIVE) condition.REMARKS: 11 sec. primer fired into booster. Fuze armed.Photo No. Signed
R. T. CROWELL, Jr
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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIAIMPACT NO. 39973IMPACT DATE 5-28-52NPG TEST NO. T-2219-1.8OBJECT Impact test of Ex-200 Electric Bomb Fuze in
250# G.P. BombReference: NPG ~~Report~~ Report No. 1048 datedReference: ~~EX-200~~ EX-200 ~~Tr. No. 1258~~ Tr. No. 1258 dated Ser C1811 of 9 Oct 1951Task Assignment No. NPG-R-26-20-1-52 dated 4 Aug 1951PLATE TARGETGage 170 Class STS
Maker Lukens
No. 50 Group L-30
Dimensions 96" x 34.8"OBLIQUITY 0°PENETRATION CompleteThickness at impact 170
No. of impact on plate 5
Dist. from nearest impact 35"
Dist. from near edges 4.8" and 11.5"
Impact area 18" x 39"
Spall: Front 0 Back 0
Dish 5" Spur 34"
Cracks 0
Punching (thrown) (started)
Back Button (thrown) (started)
Bulge 0
Through opening 16" x 36"BOMBHEAD: Cal. 5" Type G.P. Bomb
Mark M57 Mod No. Wt. 250.0#
Maker -
Lot No. -
Filler: Type Vern. Wt. -
Fuzes Ex-200 Mod 3 #1073 with
primers & dets
Boosters 2
Wt. of head (as fired) 250.0#MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 95° Wt. 80.10#COMPLETE ROUND: Mark - Mod -
Wt. (as fired) 330.10#
Wt. (burned) -OTHER INFORMATION RMDA-957-HA-45
" -100-H-45
" " "LAUNCHER 500 ft. Rocket Launcher

ROCKET PERFORMANCE

Flight Mean Velocity, f/s: 939 Residual -
Fuze functioning -
Explosive action (High Order) (Low Order) (None) -
Distance of burst behind plate -
Condition of recovered round Head was in (EFFECTIVE) (INEFFECTIVE) condition.REMARKS: Fuze not recovered.Photo No. -Signed R. T. Crowell
R. T. CROWELL, 1h
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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIAIMPACT NO. 39999IMPACT DATE 6-9-52NPG TEST NOT-2219-1.8OBJECT Impact Test of EX-200 Electric Bomb Fuze in 250#W/ G.P. Bomb val 10 STS PlateReference: NPG 1100 W/ FOL/AL-11238 MARK 57 dated 20 Oct 1951
Reference: BuOrd ltr. NPG-2219-1-52 dated 4 Nov 1951
Task Assignment No. _____ dated _____

PLATE TARGET

Report No. 1048

ROCKET

Gage 170 Class STS
Maker Lukens
No. 50 Group L-30
Dimensions 96" X 348"OBLIQUITY 0°PENETRATION Complete
Thickness at impact 170
No. of impact on plate 6
Dist. from nearest impact 42"
Dist. from near edges 55" and 72"
Impact area 15" X 39"
Spall: Front 0 Back 0
Dish 3" Spur 4"
Cracks 0
Punching (thrown) (started)
Back Button (thrown) (started)
Bulge 0
Through opening 13-1/2" X 35"HEAD: Cal. 5" Type G.P. Bomb
Mark ANM57 Mod AI No. _____ Wt. 255.00#
Maker _____
Lot No. _____
Filler: Type Verm. Wt. _____
Fuzes EX-200 Mod. 3 No 1103
W/Primer Det. & Arming Squibs
Boosters 2
Wt. of head (as fired) 255.00#MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 120° Wt. 81.30#COMPLETE ROUND: Mark _____ Mod _____
Wt. (as fired) 336.30#
Wt. (burned) _____OTHER INFORMATION AIN: RMDA-44-MCA-45
RMDA-426-HA-45 RMDA-695-HA-45LAUNCHER 1050' Rocket Launcher
(500')

ROCKET PERFORMANCE

Mean

Flight P. 31 Velocity, f/s: Striking 944 Residual _____
Fuze functioning P. 100 at 100'
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered roundImpact
Bomb was in (EFFECTIVE) (INTACT) condition.REMARKS: 53 switch fired. 2 sec. actuator fired. 59 switch closed. 48 sec.
actuator did not fire. 32 did not close. 4 sec. primer fired.
3 sec. did not arm

Photo No. _____

Signed F. W. KeadorfCONFIDENTIAL
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ORD. ENG.

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U. S. NAVAL PROVING GROUND
DAHLOREN, VIRGINIAIMPACT NO. 40000IMPACT DATE 6-9-52NPG TEST NO. T-2219-1.8OBJECT Impact Test of EX-200 Electric Bomb Fuze in 250#
G.P. Bomb vs 170 Plate.Reference: NPG 1st Report No. 1048 dated _____
Reference: NO 11tr. NE/MOL/Y1 1(1258)NA.NCB dated Sar 01811 of 9 Oct 1951
Task Assignment No NPG-3e2h-20-1-52 dated 4 Aug 1951

PLATE TARGET

Gage 170 Class STS
Maker Carn.
No. 043796 Group _____
Dimensions 8'9" x 18'4" x 1"
OBLIQUITY 0°PENETRATION Complete
Thickness at impact 170
No. of impact on plate 7
Dist. from nearest impact 0
Dist. from near edges 0.1" and .76"
Impact area 12" x 21"
Spall: Front 0 Back 0
Dish 2" Spur 2"
Cracks 0
Punching (thrown) (started) _____
Back Button (thrown) (skipped) _____
Bulge 0
Through opening 11" x 20-1/2"

ROCKET

HEAD: Cal. 5" Type G.P. Bomb
Mark ANM57 Mod A1 No. _____ Wt. 252.00#
Maker _____
Lot No. _____
Filler: Type Varm. Wt. _____
Fuzes EX-200 Mod. 3 No 1208
W/Primer, Det. & Arming Squibs
Boosters 2
Wt. of head (as fired) 252.00#MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 120° Wt. 79.95#COMPLETE ROUND: Mark _____ Mod _____
Wt. (as fired) 331.95#
Wt. (burned) _____OTHER INFORMATION ALN:RMDA-22-HA-45
" -880-HA-45
" -1240-HA-45LAUNCHER 1050' Rocket Launcher
(500')

ROCKET PERFORMANCE

Flight _____ Velocity, f/s: Mean Striking 948 Residual _____
Fuze functioning _____
Explosive action (High Order) (Low Order) (None) _____
Distance of burst behind plate _____
Condition of recovered round Impact
Bomb head was in (EFFECTIVE) (EFFECTIVE) condition.REMARKS: 2 sec actuator fired 5, switch closed, 4th sec actuator did
not fire 5, switch open 11 sec primer fired fuze did not arm

Photo No. _____

Signed F.W. Kasdorf

F.W. Kasdorf

ORN. ENG.

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 40005

IMPACT DATE 6-10-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of Ex-200 Electric Bomb Fuze in
250# G. P. Bomb

Reference: NPG No. ltr. Report No. 1048 dated

Reference: Bp Ord. ltr. dated

Task Assignment No. dated

XXXXXXXXX NPG/NOI/Y1-1(1258)EA:NGH
PLATE TARGET 2b-20-1-52

Ser 01811 of 9 Oct 1951
ROCKET 951

BOMB

Gage 1"0 Class STS
Maker CARNEGIE
No. 043796 Group
Dimensions 105" x 220"

HEAD: Cal. Type G. P. Bomb
Mark ANM57 Mod A-1 No. Wt. 250.00#
Maker
Lot No.
Filler: Type Verm Wt.
Fuzes Ex-200 Mod 3 with primers
Dets and arming squids No 1052
Boosters 2
Wt. of head (as fired) 250.00#

OBLIQUITY 0°

PENETRATION Complete
Thickness at impact 1"0
No. of impact on plate
Dist. from nearest impact 44"
Dist. from near edges 34" and 1100
Impact area 32" x 12"
Spall: Front - Back -
Dish 3-1/2" Spur -
Cracks -
Punching (thrown) (started)
Back Button (thrown) (started)
Bulge -
Through opening 31" x 11-1/2"

MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 120° Wt. 79.10#
COMPLETE ROUND: Mark Mod
Wt. (as fired) 329.10#
Wt. (burned)

OTHER INFORMATION RMDA-695-MA-45
" -169-MA-45
" -833-MA-45
LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight Velocity, f/s: Striking 753 Residual
Fuze functioning Mean
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round
Head was in (EFFECTIVE) (INEFFECTIVE) condition:

REMARKS: 2 sec. actuator fired. 5. switch open 4 1/2 sec actuator did
not fire. 5. switch open 11 sec actuator did not fire.
It is possible that the pyrotechnics lacked a full charge

Photo No. Signed F. W. Kaddor for RTC

R. T. CROWLEY Jr.
Ord. Eng.

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IMPACT RECORD

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIAIMPACT NO. 40006IMPACT DATE 6-10-52NPG TEST NO. T-2219-1.8OBJECT Impact test of Ex-200 Electric Bomb Fuze in
250# G. P. BombReference: NPG No. ltr. Report No. 1048 dated _____

Reference: BuOrd ltr. _____ dated _____

Task Assignment No. _____ dated _____

XXXXX NP/Act/Al-1(1250)NA-NCBser 01611 of 9 Oct 1951PLATE TARGETBombROCKETGage QT78 Class STSMaker LukensNo. 41 Group L 21Dimensions 96" x 348"OBLIQUITY 30°PENETRATION CompleteThickness at impact QT78No. of impact on plate 3Dist. from nearest impact -Dist. from near edges 35" and 1106"Impact area 40" x 20-1/2"Spall: Front - Back -Dish 4 Spur -Cracks -Punching (thrown) (started) -Back Button (thrown) (started) -Bulge ---Through opening 21" x 35"HEAD: Cal. _____ Type G.P. BombMark ANM57 Mod A-1 No. _____ Wt. 250.00#

Maker _____

Lot No. _____

Filler: Type Verm. Wt. _____Fuzes Ex-200 Mod 3 with primersdets., and arming squids No 1026Boosters 2Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3Motor temp. 120° Wt. 79.50#

COMPLETE ROUND: Mark _____ Mod _____

Wt. (as fired) 329.50#

Wt. (burned) _____

OTHER INFORMATION RMDA-400-MCA-45" -426-HA-45" -833-HA-45LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight _____ Velocity, f/s: Mean 954 Residual _____

Fuze functioning _____

Explosive action (High Order) (Low Order) (None) _____

Distance of burst behind plate _____

Condition of recovered round _____

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS: 2 sec. actuator fired. S. switch open 4 1/2 sec actuatordid not fire. S. switch open. 11 sec primer did not fire.It is possible that the pyrotechnics lacked a full charge.

Photo No. _____

Signed F.W. Kearney for RTCR. T. CROWELL, CLHORD. ENG.CONFIDENTIAL
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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 40007

IMPACT DATE 6-11-52

NPG TEST NO. T-2219-1.2

OBJECT Impact test of Ex-200 Electric Bomb Fuze in
250# G. P. Bomb

Reference: NPG No. ltr. Report No. 1248 dated

Reference: BuOrd ltr. dated

Task Assignment No. dated

ATTN: HF/ORD/CI-11253/DAHLGREN

Ser. 01-11 of 9 Oct 1-51

PLATE TARGET 250# G. P. Bomb

Bomb

ROCKET 1951

Gage 0778 Class STS
Maker Lukens
No. 41 Group L21
Dimensions 96" x 348"

OBLIQUITY 45°

PENETRATION Complete
Thickness at impact 0778
No. of impact on plate 4
Dist. from nearest impact 115"
Dist. from near edges T58 and R45"
Impact area 16" x 45"
Spall: Front 0 Back 0
Dish 5" Spur 17"
Cracks 0
Punching (thrown) (started)
Back Button (thrown) (started)
Bulge 0
Through opening 15" x 43"HEAD: Cal. Type G.P. Bomb
Mark ANM57A Mod No. Wt. 250.00#
Maker
Lot No.
Filler: Type Verm. Wt.
Fuzes Ex-200 Mod 3 No 1272
(explosive unknown)
Boosters 2
Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 120° Wt. 82.30#COMPLETE ROUND: Mark Mod
Wt. (as fired) 332.30#
Wt. (burned)OTHER INFORMATION RMDA-1240-BA-45
" -400-MCA-45
" -991-BA-45

LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight Velocity, f/s: Mean 946 Residual
Fuze functioning
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round
Head was in (EFFECTIVE) (INACT) condition.REMARKS: 2 sec actuator fired. S. switch partially closed. 4 1/2 sec
actuator did not fire. S. switch open. 11 sec. pressure did not rise.
It is possible that the pyrotechnic lacked a full charge.

Photo No.

Signed F. W. Kardor for RTC
R. T. CROWELL, 1h
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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIAIMPACT NO. 40008IMPACT DATE 6-11-52NPG TEST NO. T-2219-1.8OBJECT Impact test of Ex-200 Electric Bomb Fuze in 250#
G. P. BombReference: NPG ltr. Report No. 1045 dated _____
Reference: BuOrd ltr. NP/ADL/1-1(1258)WA-MCB dated ser C1211 of 2 Oct 1951
Task Assignment No. NPG-52b-20-1-52 dated 4 Aug 1951

PLATE TARGET

Gage C#78 Class STS
Maker Lukens
No. 41 Group L21
Dimensions 96" x 348"OBLIQUITY 45°PENETRATION Complete
Thickness at impact C#78
No. of impact on plate 5
Dist. from nearest impact 63"
Dist. from near edge 141" and 142"
Impact area 17" x 34"
Spall: Front 0 Back 0
Dish 4" Spur 13"
Cracks 0
Punching (thrown) (started)
Back Button (thrown) (started)
Bulge 0
Through opening 16" x 29"

Bomb

ROCKET

HEAD: Cal. _____ Type G. P. Bomb
Mark ANM57A1 Mod _____ No. Wt. 250.00#
Maker _____
Lot No. _____
Filler: Type Vern. Wt. _____
Fuzes Ex-200 Mod 3 No 1234
(explosive unknown)
Boosters 2
Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3
Motor temp. 120° Wt. 80.85#COMPLETE ROUND: Mark _____ Mod _____
Wt. (as fired) 330.85#
Wt. (burned) _____OTHER INFORMATION RMDA-957-NA-45
" 1020-NA-45
" " "LAUNCHER 500 ft. Launcher

ROCKET PERFORMANCE

Flight _____ Velocity, f/s: Mean Striking 952 Residual _____
Fuze functioning Yes
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate _____
Condition of recovered round Intact
Head was in (EFFECTIVE) (INEFFECTIVE) condition.REMARKS: Sn switch functioned but did not operate 3 switches
if one primer did not fire it is possible that the pyrotechnics
looked a full charge

Photo No. _____

Signed F. W. Kasdorf for RTC
R. T. CROWELL, IN
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XP9-50746

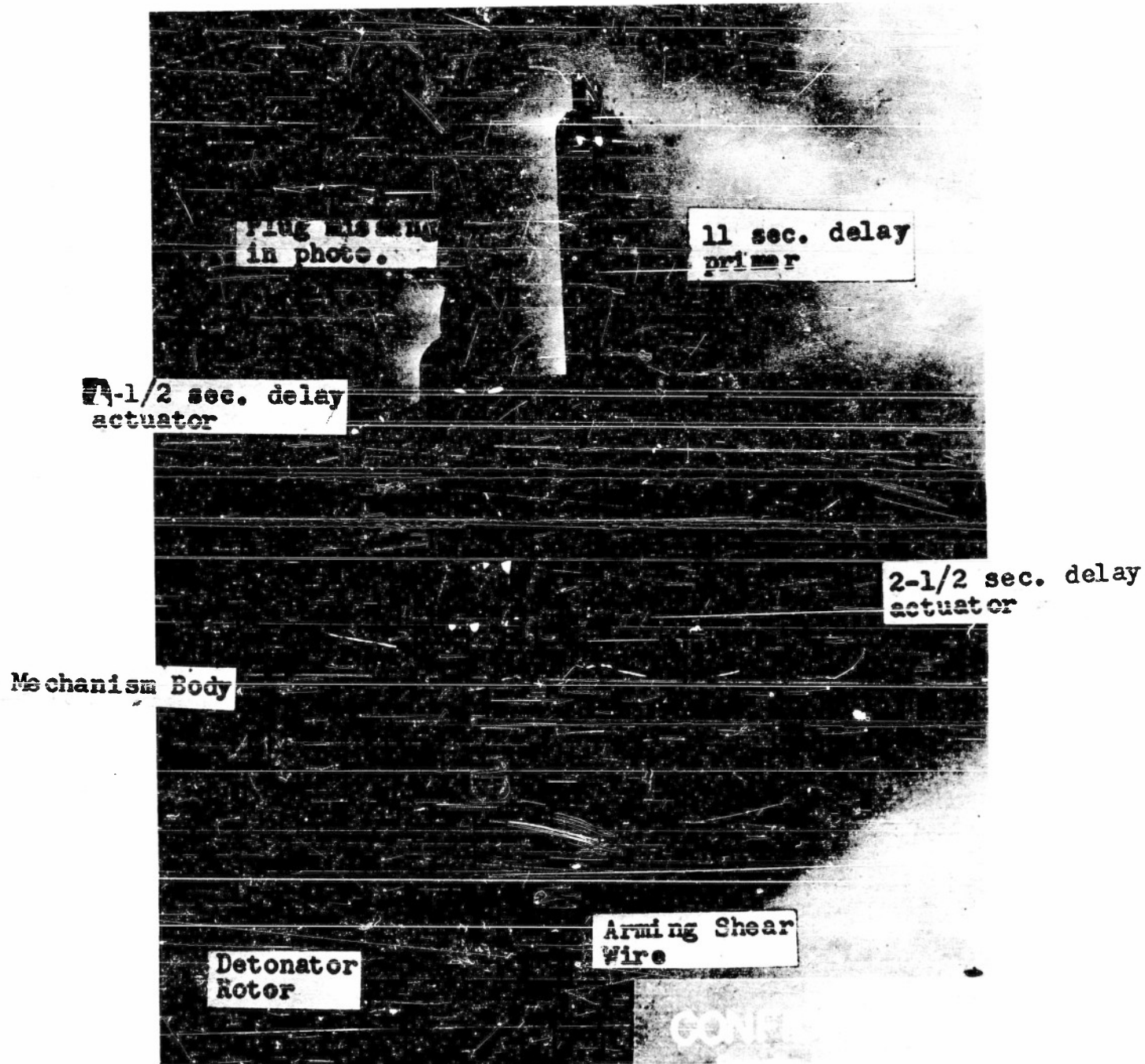
Electric Bomb Fuze LX-200 Mod 3

View: Assembled fuze and its components.
Figure 1

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NP9-50747

Electric Bomb Fuze Ex-200 Mod 3. View: Mechanical Component Block.

Figure 2

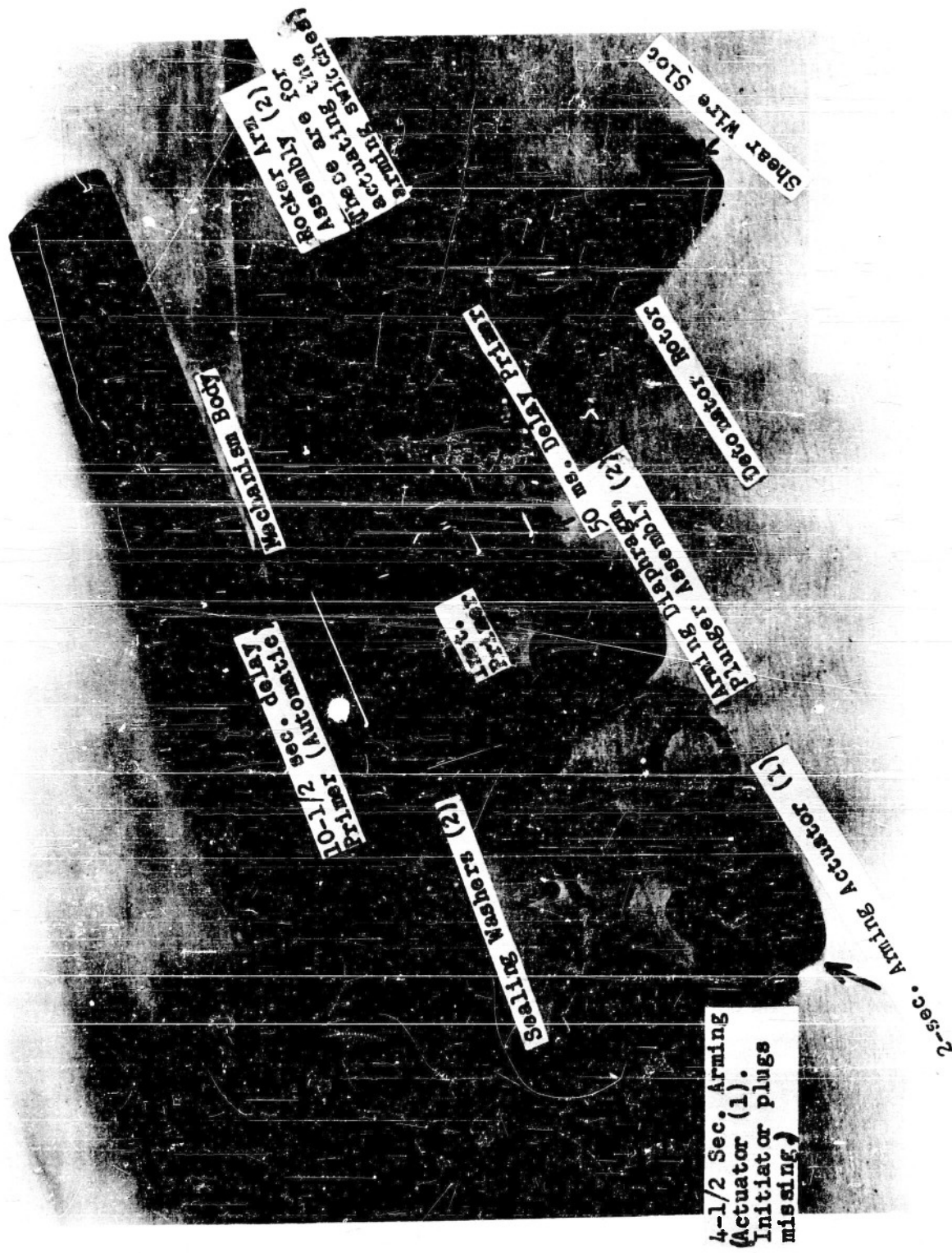
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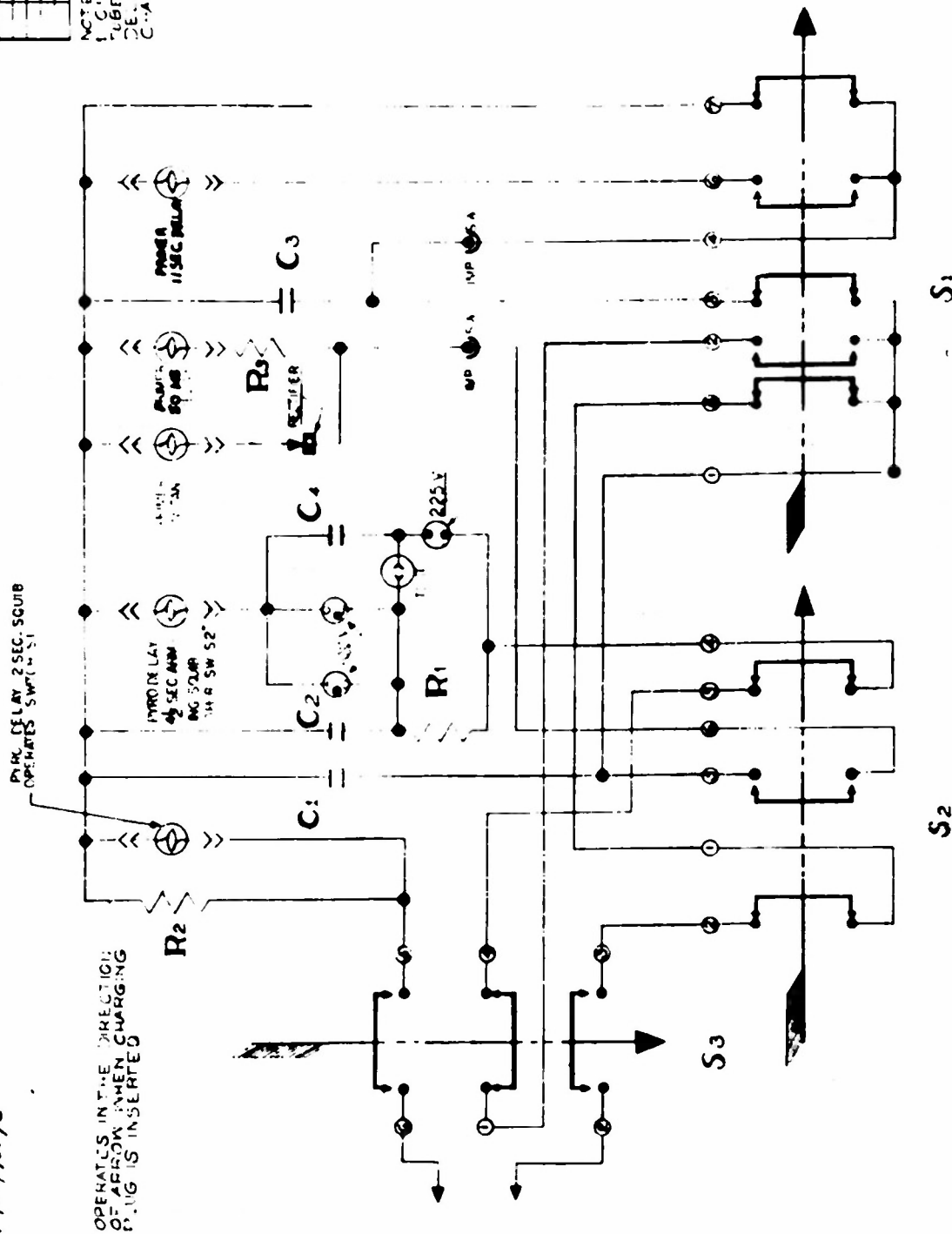
Electric Bomb Fuze X-200 Lot 3. View: Exploded view of Mechanical Component Block.

Figure 3



[illegible]

NOTES:
1. CIRCUIT C2 AND NO. 13
TUBE C 6/2 1/2 SEC.
DE-AC. ACT. C. 1. 1. 1. 1.
CHARGE TO 95 VC. 1. 1.



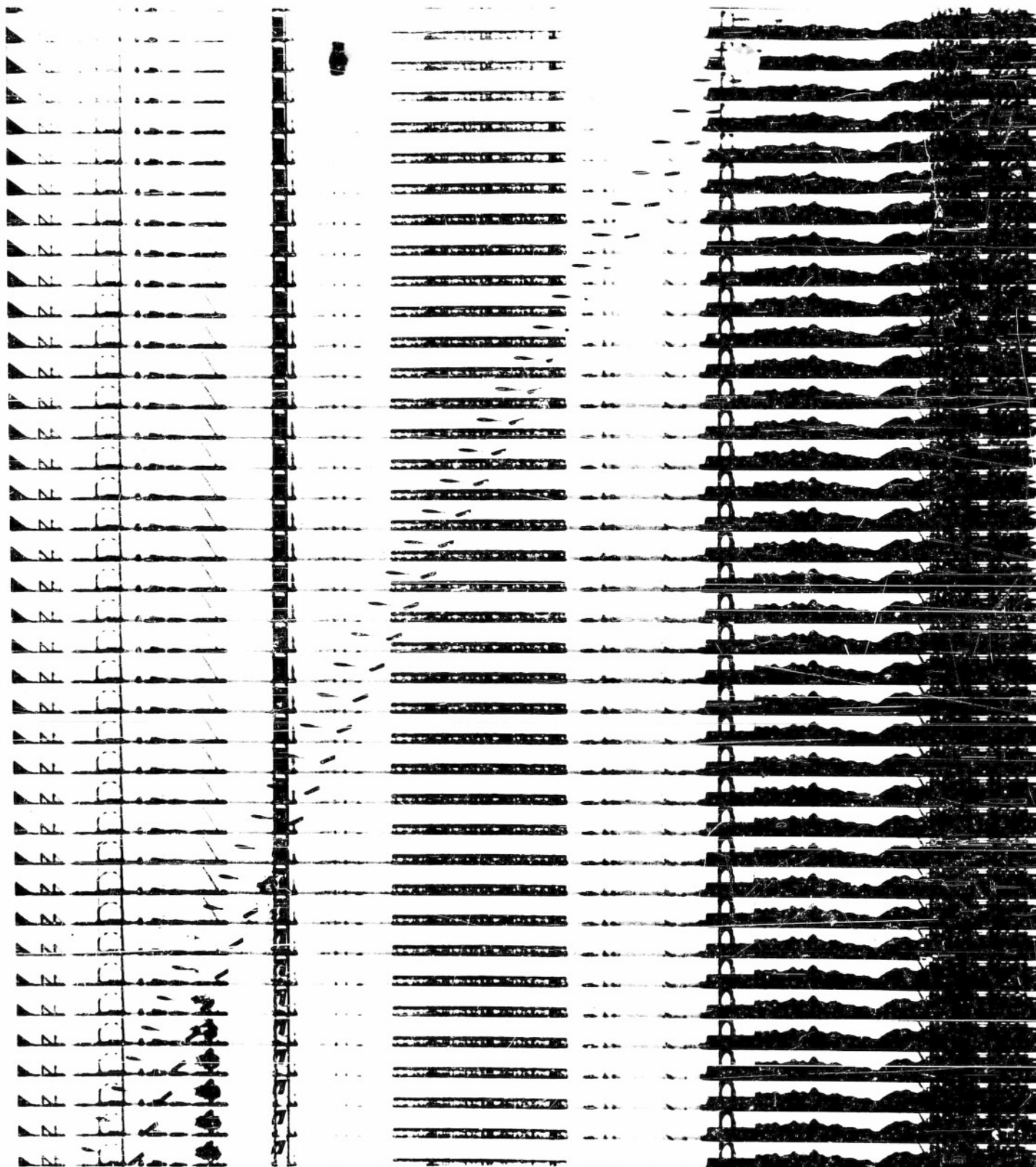
ELECTRICAL SCHEMATIC DIAGRAM

RECEIVED BY THE OFFICE OF THE ATTORNEY GENERAL
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159-0054

[illegible]





P9-47032

Electric Bomb Fuze Ex-200 Mod-3. View: Typical Sensitivity Test
Shot with fuze No 250 lb. Low Drag Bomb Ex-2 fired from NPG 500 ft.
launcher. Bomb propelled by three 500 HVAR motors in special
carriage. Separation obtained by use of 3" 25 motor in trail of
bomb. Note separation of bomb and carriage and fuze action
approximately 20 ft. beyond target.

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NP9-50752

Electric Bomb Fuze EX 200 Mod 3. View: Typical heavy impact test shot with fuze in 250 lb. G.I. bomb fired from MFG 500 ft. launcher with three 500 HVAR motors.

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Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

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NPG REPORT NO. 1048

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